

## Morphometric Analysis of Sexual Dimorphism in *Penthicodes farinosus* (Weber, 1801) (Hemiptera: Fulgoridae) from Sarawak

AHMAD IRFAN ABDUL RAZAK\*<sup>1</sup>, SITI NURLYDIA SAZALI\*<sup>1</sup>, RATNAWATI HAZALI<sup>1</sup>, FARAH NABILLAH ABU HASAN AIDIL FITRI<sup>1</sup> & ISAAC STIA MARCELLINUS<sup>2</sup>

<sup>1</sup>Faculty of Resource Science and Technology, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia; <sup>2</sup>Household and Structural Urban Entomology Laboratory, Vector Control Research Unit, School of Biological Sciences, Universiti Sains Malaysia, 11800 Penang, Malaysia.

\*Corresponding author: [irfanrzks@gmail.com](mailto:irfanrzks@gmail.com); [ssnurlydia@unimas.my](mailto:ssnurlydia@unimas.my)

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### ABSTRACT

The *Penthicodes farinosus* are strikingly coloured insects and can be found in India, Myanmar, Peninsular Malaysia, Java, Sumatra, Sulawesi, the Philippines, and Borneo. Despite their wide distributional range in Asia with a common occurrence in Borneo, morphometric investigation of *P. farinosus* is still lacking. The study is aimed to investigate the morphological variations of this species between two different sexes in Sarawak, Malaysian Borneo. Eleven morphometric characters were measured from 183 specimens (69 males and 114 females). The data were analysed using an independent *t*-test, Principal Component Analysis (PCA) and Discriminant Function Analysis (DFA). Sexual dimorphism index (SDI) was found ranging from 0.044 (LV) to 0.1008 (BTg) indicating females were larger than males. In PCA, cumulative variations of 59.9% were recorded from two principal components, showing higher loadings in the length of tegmen (LTg) and total length (TL). DFA revealed a single function that explains a canonical correlation of 0.895 with 100% variation. The Wilks' Lambda values of 0.199 were highly supported with  $p < 0.0001$ . The highest loadings for the model are LTg and TL. The two variables were further tested using Leave-One-Out Cross Validation (LOOVC) method which resulted in 97.2% cases being correctly classified as male or female. This suggests LTg and TL can be useful in separating both sexes of *P. farinosus*.

Keywords: Discriminant Function Analysis, Leave-One-Out Cross Validation, morphometric, *Penthicodes farinosus*, sexual dimorphism

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### INTRODUCTION

The family Fulgoridae are known for their striking colouration and spectacular ornamentation. The group has 142 genera and 774 species (Bourgoin, 2021). Ten species belonging to two subgenera being *Penthicodes* and *Ereosoma* are recognised within the genus *Penthicodes* (Nagai & Porion, 1996). Two of these species are in the subgenus *Penthicodes* namely *P. farinosus* and *P. nicobaricus* (Constant, 2010). *P. farinosus* has a distributional range in South Asia and Southeast Asian countries. The species has been recorded in India, Myanmar, Peninsular Malaysia, Java, Sumatra, Sulawesi, the Philippines, and Borneo (Nagai & Porion, 1996; Bosuang *et al.*, 2017).

The species can be commonly found in Borneo (Bosuang *et al.*, 2017). They feed on

many different plant species from the family Fabaceae, Arecaceae, Simaroubaceae, Ebenaceae, Lamiaceae and Apocynaceae (Razak *et al.*, 2020; Jiaranaisakul & Constant, 2022). *Penthicodes farinosus* has also been recorded in urban areas (Razak *et al.*, 2020). The species are varied with contrasting colours, with some body parts covered in wax (Figure 1). The species are nocturnal (Natanaela *et al.*, 2022) like most species in the family Fulgoridae (Naskrecki & Nishida, 2007).

Sexual dimorphism refers to a condition where two genders of a particular species exhibit differences in body size, shape, trait, colour, and parasitic load (Mori *et al.*, 2017). Sexual dimorphism in *P. farinosus* is not evident unless body size is measured. Colour assessment is unreliable as this group can discolour over time. The colouration of individuals from the same